

## CLAIMS

1. In a distributed computing environment, a method comprising:  
receiving data from a data store, the data corresponding to a plurality of  
objects; and

responsive to receiving the data, dynamically generating multiple  
hierarchies of inter-object relationships based on values of attributes of the objects,  
the multiple hierarchies of inter-object relationships being a data polyarchy.

2. A method as recited in claim 1, wherein the data store comprises a  
directory or a database.

3. A method as recited in claim 1, wherein the data polyarchy comprises  
intersecting hierarchies of inter-object relationships.

4. A method as recited in claim 1, wherein the data polyarchy comprises  
an elastic inter-object relationship.

5. A method as recited in claim 1, wherein dynamically generating  
multiple hierarchies of inter-object relationships further comprises:

identifying a dimensional relationship of one or more dimensional  
relationships between a first and second object of the objects; and

inserting the first object into the second object such that the first object is  
represented in the second object with respect to the dimensional relationship.

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3       **6.**    A method as recited in claim 1, wherein first and second objects of  
4 the objects are respectively represented in the data polyarchy as separate entities,  
5 and wherein dynamically generating multiple hierarchies of inter-object  
6 relationships further comprises:

7       identifying a dimensional relationship of one or more dimensional  
8 relationships between the first object and the second object; and

9       inserting a link to the first object in the second object with respect to the  
10 dimensional relationship.

11  
12       **7.**    A method as recited in claim 6, wherein the link is a jump gate.

13  
14       **8.**    A method as recited in claim 1, wherein the multiple hierarchies of  
15 inter-object relationships are represented independent of object naming and  
16 independent of a predetermined hierarchical data structure.

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18       **9.**    A method as recited in claim 1, wherein the inter-object relationships  
19 represent mono-directional object relationships and bi-directional object  
20 relationships.

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22       **10.**   A method as recited in claim 1, wherein is the data polyarchy  
23 comprises a membership hierarchy that provides for de-referenced dimensional  
24 navigation of a many-to-many object relationship.

1           **11.**   A method as recited in claim 1, wherein generating the data  
2 polyarchy further comprises:

3           relating a first and a second object of the objects to a third object of the  
4 objects to facilitate de-referenced dimensional navigation of a many-to-many  
5 object relationship between the first, second, and third objects.  
6

7           **12.**   A method as recited in claim 1, further comprising naming an inter-  
8 object relationship in the data polyarchy with a natural language.  
9

10          **13.**   A method as recited in claim 1, wherein generating the data  
11 polyarchy further comprises establishing, for individual ones of the objects, a  
12 plurality of predicates to indicate how to access the individual ones of the objects.  
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14          **14.**   A method as recited in claim 1, wherein generating the data  
15 polyarchy further comprises establishing for individual ones of the objects a  
16 plurality of domain properties to index the individual ones of the objects.  
17

18          **15.**   A method as recited in claim 14, wherein the domain properties  
19 comprise a data type, a data precision indication, a scale indication, and a  
20 nullability indication.  
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1        **16.**    A method as recited in claim 1, wherein generating the data  
2 polyarchy further comprises determining the relative distribution of attributes of  
3 the objects to establish a strategy to present or search for objects that comprise the  
4 attributes.

5  
6        **17.**    A method as recited in claim 1, wherein generating the data  
7 polyarchy further comprises:

8            determining the relative distribution of attributes of the objects to establish  
9 a strategy to present or search for objects that comprise the attributes, and wherein  
10 the strategy comprises one or more of the following operations:

11           a first operation to find a default search object of the objects;

12           a second operation to locate a particular object of the objects;

13           a third operation to obtain a default hierarchy of data relationships that  
14 correspond to a particular object of the objects;

15           a fourth operation to obtain a particular hierarchy of data relationships that  
16 correspond to a particular object of the objects;

17           a fifth operation to identify at least one subset of a plurality of hierarchies  
18 of data relationships that correspond to a particular object of the objects; and

19           a sixth operation to obtain multiple hierarchies of data relationships that  
20 correspond to a particular object of the objects.

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22        **18.**    A method as recited in claim 17, wherein the strategy comprises a  
23 recursive access strategy or a linear scan access strategy.  
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1           **19.**   A method as recited in claim 17, wherein the domain properties  
2           comprise a logical domain property comprising a distinguishing domain, a  
3           locating domain, or a classifying domain.

4  
5           **20.**   A method as recited in claim 1, wherein each object further  
6           comprises one or more respective attributes, and wherein generating the data  
7           polyarchy further comprises:

8               identifying a plurality of distinguishing attributes, each distinguishing  
9               attribute representing a respective object of the objects that is a root of a hierarchy,  
10              each distinguishing attribute being from a substantially unique distribution of  
11              similar attributes across the objects;

12              identifying one or more locating attributes for narrowing a search for an  
13              object of the objects; each locating attribute being from a relatively large  
14              distribution of similar attributes across the objects; and

15              identifying one or more classifying attributes for filtering out objects from a  
16              search for an object, each classifying attribute being from a relatively small  
17              distribution of similar attributes across the objects.

1  
2       **21.**   A computer for representing directory-based object inter-object  
3 relationships, the computer comprising:

4           a processor; and

5           a memory coupled to the processor, the memory comprising computer-  
6 executable instructions and data, the processor for fetching and executing the  
7 computer-executable instructions, the computer-executable instructions  
8 comprising instructions for:

9                 receiving data from a data store, the data corresponding to a plurality  
10 of objects; and

11                responsive to receiving the data, dynamically generating multiple  
12 hierarchies of inter-object relationships based on values of attributes of the objects,  
13 the multiple hierarchies of inter-object relationships being a data polyarchy.

14  
15       **22.**   A computer as recited in claim 21, wherein the data store comprises  
16 a directory or a database.

17  
18       **23.**   A computer as recited in claim 21, wherein the data polyarchy  
19 comprises intersecting hierarchies of inter-object relationships.

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21       **24.**   A computer as recited in claim 21, wherein the data polyarchy  
22 comprises an elastic inter-object relationship.

1           **25.**   A computer as recited in claim 21, wherein the computer-executable  
2 instructions for dynamically generating multiple hierarchies of inter-object  
3 relationships further comprise instructions for:

4           identifying a dimensional relationship of one or more dimensional  
5 relationships between a first and second object of the objects; and

6           inserting the first object into the second object such that the first object is  
7 represented in the second object with respect to the dimensional relationship.

8  
9           **26.**   A computer as recited in claim 21, wherein first and second objects  
10 of the objects are respectively represented in the data polyarchy as separate  
11 entities, and wherein the computer-executable instructions for dynamically  
12 generating multiple hierarchies of inter-object relationships further comprise  
13 instructions for:

14           identifying a dimensional relationship of one or more dimensional  
15 relationships between the first object and the second object; and

16           inserting a link to the first object in the second object with respect to the  
17 dimensional relationship.

18  
19           **27.**   A computer as recited in claim 26, wherein the link is a jump gate.

20  
21           **28.**   A computer as recited in claim 21, wherein the multiple hierarchies  
22 of inter-object relationships are represented independent of object naming and  
23 independent of a predetermined hierarchical data structure.

1           **29.**   A computer as recited in claim 21, wherein the inter-object  
2 relationships represent mono-directional object relationships and bi-directional  
3 object relationships.

4  
5           **30.**   A computer as recited in claim 21, wherein is the data polyarchy  
6 comprises a membership hierarchy that provides for de-referenced dimensional  
7 navigation of a many-to-many object relationship.

8  
9           **31.**   A computer as recited in claim 21, wherein the computer-executable  
10 instructions for generating the data polyarchy further comprise instructions for:

11           relating a first and a second object of the objects to a third object of the  
12 objects to facilitate de-referenced dimensional navigation of a many-to-many  
13 object relationship between the first, second, and third objects.

14  
15           **32.**   A computer as recited in claim 21, wherein the computer-executable  
16 instructions for generating the data polyarchy further comprises instructions for  
17 establishing, for individual ones of the objects, a plurality of predicates to indicate  
18 how to access the individual ones of the objects.

19  
20           **33.**   A computer as recited in claim 21, wherein the computer-executable  
21 instructions for generating the data polyarchy further comprise instructions for  
22 establishing for individual ones of the objects a plurality of domain properties  
23 identify to index the individual ones of the objects.



1           **34.**    A computer as recited in claim 33, wherein the domain properties  
2 comprise a data type, a data precision indication, a scale indication, and a  
3 nullability indication.

4  
5           **35.**    A computer as recited in claim 21, wherein the computer-executable  
6 instructions for generating the data polyarchy further comprise instructions for  
7 determining the relative distribution of attributes of the objects to establish a  
8 strategy to present or search for objects that comprise the attributes.

9  
10          **36.**    A computer as recited in claim 21, wherein the computer-executable  
11 instructions for generating the data polyarchy further comprise instructions for:

12           determining the relative distribution of attributes of the objects to establish  
13 a strategy to present or search for objects that comprise the attributes, and wherein  
14 the strategy comprises one or more of the following operations:

15           a first operation to find a default search object of the objects;

16           a second operation to locate a particular object of the objects;

17           a third operation to obtain a default hierarchy of data relationships that  
18 correspond to a particular object of the objects;

19           a fourth operation to obtain a particular hierarchy of data relationships that  
20 correspond to a particular object of the objects;

21           a fifth operation to identify at least one subset of a plurality of hierarchies  
22 of data relationships that correspond to a particular object of the objects; and

23           a sixth operation to obtain multiple hierarchies of data relationships that  
24 correspond to a particular object of the objects.  
25

1           **37.**   A computer as recited in claim 36, wherein the strategy comprises a  
2 recursive access strategy or a linear scan access strategy.

3  
4           **38.**   A computer as recited in claim 36, wherein the domain properties  
5 comprise a logical domain property comprising a distinguishing domain, a  
6 locating domain, or a classifying domain.

7  
8           **39.**   A computer as recited in claim 21, wherein each object further  
9 comprises one or more respective attributes, and wherein the computer-executable  
10 instructions for generating the data polyarchy further comprise instructions for:

11           identifying a plurality of distinguishing attributes, each distinguishing  
12 attribute representing a respective object of the objects that is a root of a hierarchy,  
13 each distinguishing attribute being from a substantially unique distribution of  
14 similar attributes across the objects;

15           identifying one or more locating attributes for narrowing a search for an  
16 object of the objects; each locating attribute being from a relatively large  
17 distribution of similar attributes across the objects; and

18           identifying one or more classifying attributes for filtering out objects from a  
19 search for an object, each classifying attribute being from a relatively small  
20 distribution of similar attributes across the objects.

21  
22           **40.**   A data structure comprising:

23           a plurality of virtual object data fields, each virtual object data field  
24 corresponding to a respective object of a plurality of objects in a data store, the  
25

1 virtual object data fields indicating multiple hierarchies of inter-object  
2 relationships based on attributes of the objects.

3  
4 **41.** A data structure as recited in claim 40, wherein the data store is a  
5 directory or a database.

6  
7 **42.** A data structure as recited in claim 40, wherein each virtual object  
8 data field further comprises:

9 a first globally unique identifier (GUID) data field to uniquely identify a  
10 corresponding object in the data store.

11  
12 **43.** A data structure as recited in claim 40, wherein a virtual object data  
13 field corresponds to a first object of the objects, and wherein the virtual object data  
14 field further comprises an entity reference data field to uniquely identify a second  
15 object of the objects as a sub-element of the first object, the entity reference data  
16 field uniquely identifying the second object in the data store.

17  
18 **44.** A data structure as recited in claim 43, wherein the entity reference  
19 is a GUID.

20  
21 **45.** A data structure as recited in claim 40, wherein each virtual data  
22 object data field further comprises one or more predicate data fields, each  
23 predicate data field indicating a respective operation to present a particular object  
24 with respect to one or more hierarchies of inter-object relationships.

1           **46.**    A data structure as recited in claim 40, wherein each virtual data  
2 object data field further comprises:

3           a domain property data field to index a corresponding object of the objects  
4 with respect to one or more hierarchies of inter-object relationships.

5  
6           **47.**    A data structure as recited in claim 46, wherein the domain property  
7 data field further comprises:

8           a physical domain comprising a data type, a data precision indication, a  
9 scale indication, or a nullability indication; and

10          a logical domain comprising a unique domain, a locating domain, or a  
11 classifying domain.

12  
13          **48.**    A computer-readable medium having stored thereon a data structure  
14 as recited in claim 40.

15  
16          **49.**    A computer-readable medium comprising computer-executable  
17 instructions for:

18          receiving data from a data store, the data corresponding to a plurality of  
19 objects; and

20          responsive to receiving the data, dynamically generating multiple  
21 hierarchies of inter-object relationships based on values of attributes of the objects,  
22 the multiple hierarchies of inter-object relationships being a data polyarchy.

1           **50.**    A computer-readable medium as recited in claim 49, wherein the  
2 data store comprises a directory or a database.

3  
4           **51.**    A computer-readable medium as recited in claim 49, wherein the  
5 data polyarchy comprises intersecting hierarchies of inter-object relationships.

6  
7           **52.**    A computer-readable medium as recited in claim 49, wherein the  
8 data polyarchy comprises an elastic inter-object relationship.

9  
10          **53.**    A computer-readable medium as recited in claim 49, wherein the  
11 data polyarchy comprises a complex object that is related to one or more sub-  
12 objects in the data polyarchy, and wherein the computer-executable instructions  
13 for determining inter-object relationships further comprise instructions for:

14           representing the complex object as an independent surface entity; and

15           referencing the one or more sub-objects in the independent surface entity as  
16 separate entities, the one or more sub-objects being referenced independent of  
17 object naming and independent of a hierarchical data relationship between the  
18 surface entity and the one or more sub-objects.

19  
20          **54.**    A computer-readable medium as recited in claim 49, wherein the  
21 data polyarchy comprises a first object that is related to one or more sub-objects in  
22 the data polyarchy, and wherein the computer-executable instructions for  
23 determining the inter-object relationships further comprise instructions for:

24           representing the first object as a surface entity;  
25

1        representing each of the one or more sub-objects as respective separate  
2 entities that are independent of the surface entity; and

3        referencing the surface object in each of the one or more sub-objects  
4 independent of any object naming or hierarchical relationship.  
5

6        **55.**    A computer-readable medium as recited in claim 49, wherein the  
7 multiple hierarchies of inter-object relationships are represented independent of  
8 object naming and independent of a predetermined hierarchical data structure.  
9

10       **56.**    A computer-readable medium as recited in claim 49, wherein the  
11 inter-object relationships represent mono-directional object relationships and bi-  
12 directional object relationships.  
13

14       **57.**    A computer-readable medium as recited in claim 49, wherein is the  
15 data polyarchy comprises a membership hierarchy that provides for de-referenced  
16 dimensional navigation of a many-to-many object relationship.  
17

18       **58.**    A computer-readable medium as recited in claim 49, wherein the  
19 computer-executable instructions for generating the data polyarchy further  
20 comprise instructions for:

21       relating a first and a second object of the objects to a third object of the  
22 objects to facilitate de-referenced dimensional navigation of a many-to-many  
23 object relationship between the first, second, and third objects.  
24  
25

1           **59.**   A computer-readable medium as recited in claim 49, wherein the  
2 computer-executable instructions for generating the data polyarchy further  
3 comprises instructions for establishing, for individual ones of the objects, a  
4 plurality of predicates to indicate how to access the individual ones of the objects.

5  
6           **60.**   A computer-readable medium as recited in claim 49, wherein the  
7 computer-executable instructions for generating the data polyarchy further  
8 comprise instructions for determining the relative distribution of attributes of the  
9 objects to establish a strategy to present or search for objects that comprise the  
10 attributes.

11  
12           **61.**   A computer-readable medium as recited in claim 49, wherein each  
13 object further comprises one or more respective attributes, and wherein the  
14 computer-executable instructions for generating the data polyarchy further  
15 comprise instructions for:

16           identifying a plurality of distinguishing attributes, each distinguishing  
17 attribute representing a respective object of the objects that is a root of a hierarchy,  
18 each distinguishing attribute being from a substantially unique distribution of  
19 similar attributes across the objects;

20           identifying one or more locating attributes for narrowing a search for an  
21 object of the objects; each locating attribute being from a relatively large  
22 distribution of similar attributes across the objects; and

23           identifying one or more classifying attributes for filtering out objects from a  
24 search for an object, each classifying attribute being from a relatively small  
25 distribution of similar attributes across the objects.

1           **62.**    A computer-readable medium as recited in claim 49, wherein the  
2 computer-executable instructions for generating the data polyarchy further  
3 comprise instructions for establishing for individual ones of the objects a plurality  
4 of domain properties identify to index the individual ones of the objects.

5  
6           **63.**    A computer-readable medium as recited in claim 62, wherein the  
7 domain properties comprise a data type, a data precision indication, a scale  
8 indication, and a nullability indication.

9  
10          **64.**    A computer-readable medium as recited in claim 49, wherein the  
11 computer-executable instructions for generating the data polyarchy further  
12 comprise instructions for:

13           determining the relative distribution of attributes of the objects to establish  
14 a strategy to present or search for objects that comprise the attributes, and wherein  
15 the strategy comprises one or more of the following operations:

16           a first operation to find a default search object of the objects;

17           a second operation to locate a particular object of the objects;

18           a third operation to obtain a default hierarchy of data relationships that  
19 correspond to a particular object of the objects;

20           a fourth operation to obtain a particular hierarchy of data relationships that  
21 correspond to a particular object of the objects;

22           a fifth operation to identify at least one subset of a plurality of hierarchies  
23 of data relationships that correspond to a particular object of the objects; and

24           a sixth operation to obtain multiple hierarchies of data relationships that  
25 correspond to a particular object of the objects.



1  
2       **65.**    A computer-readable medium as recited in claim 64, wherein the  
3 strategy comprises a recursive access strategy or a linear scan access strategy.  
4

5       **66.**    A computer-readable medium as recited in claim 64, wherein the  
6 domain properties comprise a logical domain property comprising a distinguishing  
7 domain, a locating domain, or a classifying domain.  
8

9       **67.**    A computer for representing directory-based object inter-object  
10 relationships, the computer comprising processing means for:

11           receiving data from a data store, the data corresponding to a plurality  
12 of objects; and

13           responsive to receiving the data, dynamically generating multiple  
14 hierarchies of inter-object relationships based on values of attributes of the objects,  
15 the multiple hierarchies of inter-object relationships being a data polyarchy.  
16

17       **68.**    A computer as recited in claim 67, wherein the data polyarchy  
18 comprises intersecting hierarchies of inter-object relationships.  
19

20       **69.**    A computer as recited in claim 67, wherein the data polyarchy  
21 comprises an elastic inter-object relationship.  
22  
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1           **70.** A computer as recited in claim 67, wherein the means for  
2 dynamically generating multiple hierarchies of inter-object relationships further  
3 comprise means for:

4           identifying a dimensional relationship of one or more dimensional  
5 relationships between a first and second object of the objects; and

6           inserting the first object into the second object such that the first object is  
7 represented in the second object with respect to the dimensional relationship.

8  
9           **71.** A computer as recited in claim 67, wherein first and second objects  
10 of the objects are respectively represented in the data polyarchy as separate  
11 entities, and wherein the means for dynamically generating multiple hierarchies of  
12 inter-object relationships further comprise means for:

13           identifying a dimensional relationship of one or more dimensional  
14 relationships between the first object and the second object; and

15           inserting a link to the first object in the second object with respect to the  
16 dimensional relationship.

17  
18           **72.** A computer as recited in claim 68, wherein the link is a jump gate.

19  
20           **73.** A computer as recited in claim 67, wherein the multiple hierarchies  
21 of inter-object relationships are represented independent of object naming and  
22 independent of a predetermined hierarchical data structure.

1        74.    A computer as recited in claim 67, wherein is the data polyarchy  
2 comprises a membership hierarchy that provides for de-referenced dimensional  
3 navigation of a many-to-many object relationship.

4  
5        75.    A computer as recited in claim 67, wherein the means for generating  
6 the data polyarchy further comprise means for:

7        relating a first and a second object of the objects to a third object of the  
8 objects to facilitate de-referenced dimensional navigation of a many-to-many  
9 object relationship between the first, second, and third objects.

10  
11       76.    A computer as recited in claim 67, wherein the means for generating  
12 the data polyarchy further comprises means for establishing, for individual ones of  
13 the objects, a plurality of predicates to indicate how to access the individual ones  
14 of the objects.

15  
16       77.    A computer as recited in claim 67, wherein the means for generating  
17 the data polyarchy further comprise means for establishing for individual ones of  
18 the objects a plurality of domain properties identify to index the individual ones  
19 of the objects.

20  
21       78.    A computer as recited in claim 77, wherein the domain properties  
22 comprise a data type, a data precision indication, a scale indication, and a  
23 nullability indication.

1           **79.**     A computer as recited in claim 67, wherein the means for generating  
2 the data polyarchy further comprise means for determining the relative distribution  
3 of attributes of the objects to establish a strategy to present or search for objects  
4 that comprise the attributes.

5  
6           **80.**     A computer as recited in claim 67, wherein the means for generating  
7 the data polyarchy further comprise means for:

8           determining the relative distribution of values assumed by attributes of the  
9 objects to establish a strategy to present or search for objects that comprise the  
10 attributes, and wherein the strategy comprises one or more of the following  
11 operations:

12           a first operation to find a default search object of the objects;

13           a second operation to locate a particular object of the objects;

14           a third operation to obtain a default hierarchy of data relationships that  
15 correspond to a particular object of the objects;

16           a fourth operation to obtain a particular hierarchy of data relationships that  
17 correspond to a particular object of the objects;

18           a fifth operation to identify at least one subset of a plurality of hierarchies  
19 of data relationships that correspond to a particular object of the objects; and

20           a sixth operation to obtain multiple hierarchies of data relationships that  
21 correspond to a particular object of the objects.

22  
23           **81.**     A computer as recited in claim 80, wherein the strategy comprises a  
24 recursive access strategy or a linear scan access strategy.  
25

1           **82.**     A computer as recited in claim 80, wherein the domain properties  
2     comprise a logical domain property comprising a distinguishing domain, a  
3     locating domain, or a classifying domain.

4  
5           **83.**     A computer as recited in claim 67, wherein each object further  
6     comprises one or more respective attributes, and wherein the means for generating  
7     the data polyarchy further comprise means for:

8           identifying a plurality of distinguishing attributes, each distinguishing  
9     attribute representing a respective object of the objects that is a root of a hierarchy,  
10    each distinguishing attribute being from a substantially unique distribution of  
11    similar attributes across the objects;

12          identifying one or more locating attributes for narrowing a search for an  
13    object of the objects; each locating attribute being from a relatively large  
14    distribution of similar attributes across the objects; and

15          identifying one or more classifying attributes for filtering out objects from a  
16    search for an object, each classifying attribute being from a relatively small  
17    distribution of similar attributes across the objects.